as nearly all the houses had cellars under the public street; but for the last two years the town has been lighted by means of electricity. The price charged is either at a fixed rate per month, independently of the number of hours the lamp is lighted, or the consumer can pay for the actual time the lamps are used at the rate of 5½ centimes per hour for a 16-candle lamp, 4 centimes for a 10-candle lamp, and 3½ centimes if the lamp be of 8 candles. It is interesting to notice that this charge of 5½ centimes per hour for a 16-candle lamp is almost exactly equivalent to 8*d.* per Board of Trade unit—the legalized rate for London.

At Perpignan, the prices per hour per lamp are the same as at Manosque, but if the lighting be charged at a fixed rate per month, the rate for a 10-candle lamp is either 3½ or 6 or 8 francs per month, depending on whether the lamp is put out every night at 10 o'clock or at midnight, or is left alight all night.

In Paris, gas costs 30 centimes per cubic metre, or, roughly, 7*s.* 6*d.* per 1000 cubic feet, while, for a 10-candle glow-lamp, 4·8 centimes per hour is charged; the user has also to pay an annual subscription of 4 francs, and he has to replace his lamp after 1000 hours at a cost of 4 francs. With these figures the author concludes that electric lighting with glow-lamps is 40 per cent. dearer than lighting with gas.

The largest single electric installations of *arc*-lamps is at Brooklyn, in America, where the Thomson-Houstin Company supply current for 1325. The following the author gives as the prices paid per hour for the current for one arc-lamp:—

Detroit	29 centimes.	
Paris	40 ,,	
Milan	44 ,,	if burning all night.
,, ...	50·2 ,,	,, only until midnight.
Marseilles ...	52·5 ,,	burning only until midnight.

To enable a comparison to be made, we have ascertained that the yearly price charged for the arc-lamps on the Parades of the English watering-places is equivalent to about 35 centimetres per arc-lamp per hour.

M. Jules Couture concludes his treatise in a very judicious manner as an old director of the Marseilles Gas Company:—"Little Jack Gas lives still, and will continue to live, I hope, for a long time yet. To prolong its existence, gas will not hesitate to inscribe on its banner, 'Gas-Electricity,' because its advocates are not at all adverse to progress."

The treatise forms a handy reference-book for those interested in the progress of electric lighting. It would have been well, however, if the author had given the price of *electric energy* in the various towns, instead of the price per ampere or the price for the current for a particular lamp. Constant reference is made to the supply of the light "*au moyen de compteurs*" in the various towns. Electrical engineers would have gladly welcomed some information as regards the character and the behaviour, satisfactory or otherwise, of the meters employed. We have already said that we think statistics of electric lighting in Great Britain might well have been added, seeing that it is now nearly two years ago since the Englishman's backwardness in taking up electric lighting began to disappear.

In justice to the consumers of gas, more stress should have been laid on the fact that ordinary gas-burners are very inefficient things. It might, for example, have been pointed out that, while as much as 6 candles per cubic foot of gas consumed per hour can be obtained with a Welsbach or with an albo-carbon burner, as little as ¾ of a candle per cubic foot consumed per hour is the meagre efficiency of certain twopenny-halfpenny nondescript burners. And if such a nondescript burner be ungoverned, as it probably will be, since people who have not the sense to buy good gas-burners are not likely to buy governors for them, then, when the pressure of the gas rises in the mains, the burner will not give more than ½ a candle per cubic foot. So that a burner passing 5 cubic feet of London gas per hour may give any illumination from 3 to 30 candles, depending on the nature of the burner.

In dealing, therefore, with the vexed question of the relative cost of lighting with electricity and gas, we must remember that, apart from glow-lamps causing much less damage than gas to books and decorations of rooms, lighting with glow-lamps at 8*d.* per Board of Trade Unit costs no more than lighting with ungoverned common gas-burners using gas at 2*s.* 6*d.* per thousand cubic feet. On the other hand, lighting with glow-lamps costs about 3 times as much as lighting with governed Argand burners, and 4 or 5 times as much as using albo-carbon or Welsbach burners.

A TEXT-BOOK OF GEOLOGY.

The School Manual of Geology. By J. Beete Jukes, F.R.S. Fifth Edition. Edited by A. J. Jukes-Browne, B.A., F.G.S. (Edinburgh: A. and C. Black, 1890.)

THE title and success of this handy little book lead one to inquire how far and where geology is taught in schools. There is no doubt that the subject has for scholars, particularly in the country, the strongest fascination; and the fine museum of Marlborough is an example of how "natural history" studies may be kept alive in seats of youthful learning. But it would be interesting to know how many schools, excluding special evening-classes, can give such a work as this a place in their curriculum, and thus carry back the history of England, Rome, and Greece to the earliest dawn of life upon the globe. The preliminary training for the appreciation of geological features such as every lad can see around him need not be excessively severe; the mere appreciation is at first the great thing—the knowledge that there is something to be learnt in road-side quarries, in familiar hollows of the hills, beside which the "Dictionary of Antiquities" seems like a fashion-book of yesterday; while at the same time, perhaps, the kinship of the boy with his favourite classic hero becomes something more real and inspiriting in face of the enormous past beyond them both.

While the work before us is a concise and convenient text-book, we suspect that, from mere force of circumstances, it aims more at the individual student than at the school-boy and the class. Just as William Smith, at the beginning of the century, pleaded for geology as a study advantageous to land-owners, so the editor appeals in his preface to the practical good sense of parents. The

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claims of education in natural history as a means to individual and mutual happiness are perhaps too well known to need assertion; at any rate, it is not fashionable to put them forward.

For schools, one would like in this book a little more of the breath of the open country, such as appears in the few lines descriptive of the Cotteswolds; but the direct appeal to Nature in chapter ix. is very refreshing and characteristic of the author. Where, indeed, the work has been altered from the first edition of 1863, it is in matters of more recent discovery, its tone being fully preserved. Some little notes have gone, such as that on the difficulties of the Welsh "ll" on p. 216 of the original (p. 261 of the present edition is more serious); but the references to history and familiar authors remain, even to Wilkie Collins, while the introduction of derivations has been considerably and interestingly extended. Quaint effects in such matters cannot always be avoided, as in the following (p. 247), "Illænus (*squint-eye*) Davisii (*after Mr. Davis*)."

It is difficult in such a book to deal with rival theories; but the discussion of coral-islands, carried over seven pages, scarcely does justice to Darwin's position, and is certainly not complete—as in accounting for the atoll—in its statement of more recent views. Nor can we consider the treatment of the specific gravity of the earth (p. 8) as altogether beyond question, accepting as it does the continuous compressibility of crystalline bodies.

To come to small matters, the use of "potash" in different senses on pp. 46 and 48 may mislead the tyro; the spelling "tachylite" is adopted for "tachylyte"; and "Protospongia fenestella" for "fenestrata" occurs on both p. 238 and p. 239. On p. 329 we have, freshly inserted, the Pterodactyl from Owen's "Palæontology." This figure, arising from the difficulty of interpreting some of the earlier specimens, still appears in well-regulated text-books, but is sometimes accompanied with warning foot-notes; here it is aggravated by having its digits numbered, and the existence of a fifth, "answering to the little finger in our own hands," is distinctly stated in the text. But the other woodcuts are numerous and effective; and we have a few bold drawings of natural features as they actually appear, which always appeal strongly to the untrained observer. It is too much to ask for full-page sketches of our British scenery; but we look back in this matter somewhat regretfully on that earlier work of Jukes, the "Popular Physical Geology," illustrated by Du Noyer, and published with undoubted spirit by Reeve and Co. in 1853. G. C.

OUR BOOK SHELF.

Magnetism and Electricity. By W. Jerome Harrison, F.G.S., and Charles A. White. (London: Blackie and Son, 1890.)

WE note one or two features in this work which make it worthy of commendation; for example, the authors have avoided speaking of magnetic or electric fluids, and have endeavoured to bring out the fact that these forces are but "states or affections of matter," and their endeavour is much to be praised. It is also good to see an introductory chapter on "Matter and Force," and a special chapter on "Potential," about which elementary students, as a rule, know very little. Most of the diagrams, however, are of the stock kind, and with the exception of the above points the book possesses nothing to distinguish it from many other elementary manuals dealing with the same subject

Science applied to Work. By John A. Bower. (London: Cassell and Co., 1890.)

THERE is much that is praiseworthy in this little work; it is an easy introduction to mechanics, and free from all mathematical formulæ, is written in very clear language, and deals entirely with the mechanics of every-day life. The book has been designed especially for the artisan section of the National Home Reading Union, and will doubtless be a means of eradicating the rule-of-thumb work which is still characteristic of a large proportion of the artisan community. Many hints are given for making simple apparatus to demonstrate the principles laid down, the applications of these principles are well pointed out, and the work altogether meets the requirements of the class for whom it is intended.

LETTERS TO THE EDITOR.

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Testing for Colour-Blindness.

DR. OLIVER LODGE asks (May 29, p. 100) why those interested in testing for colour-vision do not employ Lord Rayleigh's arrangement, in which yellow is matched by certain proportions of red and green.

This suggests to me a difficulty I have felt for many years. I am partially colour-blind, and have the usual difficulty in seeing whether a fuchsia or a *Pyrus Japonica* is in flower or not. I have noticed that many persons speak of flowers such as *Lychnis flos-Jovis*, or *Epilobium angustifolium*, &c., as being red. I should unhesitatingly class them among blue or purple flowers. They give me no suggestion of red, but I observe that when they are coloured in botanical works, such as Sowerby's "Botany," &c., they are painted of a decidedly reddish colour, and not as they appear in Nature. I used to attribute this to carelessness, but it is now evident to me that two colours which when placed side by side appear identical to normal vision do not appear at all identical to the colour-blind. Doubtless pigments could be found which would produce similar impressions on both orders of vision, but this is only a matter of chance. An investigation on these lines might give useful information.

On the question of flag signals, I would observe that though I can make nothing out of the ordinary dull greens, reds, and browns, and am ready to believe anything that is told me about them, my impressions of scarlet and orange are intensely distinct and vivid. Scarlet (and especially orange scarlet) is the most vivid and beautiful colour which I know, and utterly unlike any other; it becomes nearly black in very faint twilight. I could recognize a flag of scarlet or orange under any possible circumstances and at almost any distance. If danger flags had this colour they would perfectly suit the ordinary colour-blind, and could never be mistaken for green.

On the subject of night signals I cannot make a useful suggestion. Green lights are very distinct, but they appear to me as a poor blue with very little power in them. Red lights are distinct enough compared side by side with ordinary yellow ones, but seen alone under unfavourable circumstances there is nothing to catch the eye or the imagination, and they might easily be mistaken for yellow or ordinary lights.

London, June 9. LATIMER CLARK.

Coral Reefs—Snail Burrows.

IN regard to Dr. von Lendenfeld's letter (May 29, p. 100) it may suffice for me to say that I had not seen his reviews of Darwin's "Coral Reefs" in the periodicals which he names (for I find it impossible to keep level with the advancing flood of scientific literature), and that if his reply "considerably modifies

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